

National Institute of Allergy and Infectious Diseases

# PROFILE

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
National Institutes of Health

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This is a stylized representation of an antibody, a protein made by the body's immune system cells to protect it against invading foreign substances.

## INTRODUCTION

The National Institute of Allergy and Infectious Diseases (NIAID) conducts and supports basic and applied research to better understand, treat, and ultimately prevent infectious, immunologic, and allergic diseases. For more than 50 years, NIAID research has led to new therapies, vaccines, diagnostic tests, and other technologies that have improved the health of millions of people in the United States and around the world. The scope of the NIAID research portfolio has expanded considerably in recent years in response to new challenges such as bioterrorism; emerging and re-emerging infectious diseases, including acquired immunodeficiency syndrome (AIDS), severe acute respiratory syndrome (SARS), West Nile virus, malaria, and tuberculosis; and the increase in asthma prevalence among children in this country. The growth of NIAID programs also has been driven by unprecedented scientific opportunities in the core NIAID scientific disciplines of microbiology, immunology, and infectious diseases. Advances in these key fields have led to a better understanding of the human immune system and the mechanisms of infectious and immune-mediated diseases.

The threat of bioterrorism has created new challenges for medicine and public health. Our nation's ability to detect and respond to acts of bioterror requires new and improved countermeasures, including diagnostics, vaccines, and therapies. The development of countermeasures is driven by biomedical research on dangerous, disease-causing microbes and on the immune system response to these pathogens. The National Institutes of

Health (NIH) and NIAID support much of this research. As the lead agency at NIH for infectious diseases and immunology research, NIAID has developed the *NIAID Strategic Plan for Biodefense Research*; the detailed *NIAID Biodefense Research Agenda for CDC Category A Agents*, with short-, intermediate-, and long-term goals; and the *NIAID Biodefense Research Agenda for Category B and C Priority Pathogens*. The strategic plan and research agendas stress two overarching and complementary components: (1) basic research into agents with bioterrorism potential and the specific and nonspecific host defense mechanisms against those agents and (2) applied research with predetermined milestones for the development of countermeasures. Advances in biodefense research have been rapid and significant, as delineated in the *NIAID Biodefense Research Agenda for CDC Category A Agents Progress Report*.

We anticipate that the large investment in research on biodefense will have many positive spinoffs for other diseases. NIAID research on microbial biology and on the pathogenesis of organisms with bioterror potential will certainly lead to a better understanding of other more common and naturally occurring infectious diseases that afflict people here and abroad. In particular, the advancement of knowledge should have an enormous positive impact on our ability to diagnose, treat, and prevent major infectious killers, such as malaria, tuberculosis, human immunodeficiency virus (HIV)/AIDS, and a spectrum of emerging and re-emerging diseases, such as West Nile virus, dengue, influenza, and multidrug-resistant microbes. Furthermore, and importantly, the NIAID

biodefense research agenda promises to enhance our understanding of the molecular and cellular mechanisms of the innate immune system and its relationship to the adaptive immune system. Such knowledge will help in the search for new ways to treat and prevent a variety of immune-mediated diseases, such as systemic lupus erythematosus, type 1 diabetes, and rheumatoid arthritis. New insights into the mechanisms of regulation of the human immune system also will have positive spinoffs for diseases such as cancer, immune-mediated neurological diseases, and allergic and hypersensitivity diseases, as well as for the prevention of rejection of transplanted organs, cells, and tissues.

Vaccine research has long been a cornerstone of NIAID research. Effective vaccines have contributed enormously to improvements in public health worldwide, and research supported by NIAID has led to new or improved vaccines for a variety of serious diseases, including rabies, meningitis, whooping cough, hepatitis A and B, chickenpox, and pneumococcal pneumonia. NIAID is committed to improving global health through the rigorous pursuit of effective vaccines for human diseases. NIAID has three broad goals in vaccine research: identifying new vaccine candidates to prevent diseases for which no vaccines currently exist, improving the safety and efficacy of existing vaccines, and designing novel vaccine approaches such as new vectors and adjuvants.

One of the important challenges for the 21st century is the development of safe and effective vaccines for the three greatest microbial killers worldwide: HIV/AIDS, malaria, and tuberculosis. These three diseases

account for one-third to one-half of healthy years lost in less developed countries. NIAID has a robust portfolio of vaccine research and development for these and other diseases of global importance, including agents of bioterrorism.

Despite recent progress in treatment and prevention, HIV disease and AIDS continue to exact an enormous toll throughout the world. Estimates on the scope of the HIV/AIDS pandemic are profoundly sobering. As of the end of 2003, an estimated 40 million people worldwide are living with HIV/AIDS, 5 million people worldwide were newly infected with HIV, and 3 million people with HIV/AIDS died. More than 95 percent of these infections and deaths have occurred in developing countries, most of which also are burdened by other significant health challenges.<sup>1</sup> To help turn the tide of the global HIV/AIDS pandemic, NIAID has established research collaborations with international colleagues in more than 50 countries to develop comprehensive approaches to the HIV pandemic, encompassing vaccine development and other prevention activities, therapeutics, and care of the HIV-infected person. These collaborations already have yielded important results, notably in developing methods to reduce mother-to-child transmission of HIV.

NIAID-sponsored researchers have made critical discoveries about the basic biology of HIV and the immune response to HIV infection, which in turn have led to the development of therapies that suppress the growth of the virus in the body. Although much has been learned in recent years, questions remain about the molecular interactions involved in the regulation of HIV

expression and replication, why the host immune response fails to control the infection, and how reservoirs of virus persist in the body despite highly active antiretroviral treatment (HAART). NIAID continues to search for more scientific information about how the virus attacks the body and how the body defends itself, which is critical for identifying additional targets for therapeutic interventions and vaccines.

An important NIAID research focus is the immune system, the complex network of cells, tissues, and organs that work together to defend the body against attacks by foreign invaders such as bacteria, viruses, parasites, and fungi. Because the human body provides an ideal environment for many microbes, they try to break in. It is the immune system's job to keep them out or, failing that, to seek out and destroy them. When the immune system hits the wrong target or is crippled, however, it can unleash a torrent of diseases, including asthma and allergy diseases, arthritis, or AIDS. NIAID-funded research in basic and clinical immunology has led to many promising approaches for treating individuals with immunologic conditions such as multiple sclerosis, type 1 diabetes, and asthma. For example, researchers are developing novel ways of selectively blocking inappropriate or destructive immune responses while leaving protective immune responses intact, an area of research known as tolerance induction. The NIAID-supported Immune Tolerance Network (ITN) is an international consortium consisting of approximately 80 basic and clinical scientists and physicians at more than 40 institutions in the United States, Canada, Europe, and Australia. ITN has 18 approved clinical protocols that are enrolling patients, or

will do so soon, in areas such as islet transplantation for type 1 diabetes, kidney transplantation, autoimmune diseases, and asthma and allergic diseases.

For the past decade, NIAID also has focused on reducing the significant and growing burden of asthma among inner-city minority children. NIAID's Inner-City Asthma Study has investigated novel interventions to improve the health of inner-city children with asthma. One approach, called a physician feedback intervention, involves periodic reports to the child's doctor about the status of the child's asthma. These reports, generated from bimonthly phone interviews with parents, recommend changes in the child's treatment regimen according to National Heart, Lung, and Blood Institute guidelines, if warranted. Another method involves an environmental intervention to identify and remove asthma triggers, such as cigarette smoke or cockroaches, from the child's home. Both interventions are reducing healthcare utilization, and the children receiving the environmental intervention gained an additional 3 weeks of symptom-free days during the intervention year. We are working to make such interventions available nationwide.

*Profile* describes the Institute's activities in areas of basic research and clinical investigation and provides overviews of the major accomplishments and goals of the various scientific programs within the Institute. *Profile* also includes information on the organization and staff of NIAID, the Institute's budget, and its extramural grants, contracts, and research training programs.

We still have much to discover about many infectious and immune-mediated diseases and how best to diagnose, treat, and prevent them. However, with a strong research base, talented investigators in the United States and abroad, and the availability of powerful new research tools, we fully expect that our basic and

applied research programs will provide the essential elements to enhance our defenses against those who would attempt to harm us with bioterrorism, to develop new tools in the fights against HIV/AIDS and other infectious diseases, and to improve therapies and management of immune-mediated diseases.

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<sup>1</sup> NIAID [Internet]. NIAID Fact Sheet: HIV/AIDS Statistics. Available from: [www.niaid.nih.gov/factsheets/aidsstat.htm](http://www.niaid.nih.gov/factsheets/aidsstat.htm).